

REMARKS

Applicants thank the Examiner for the thorough consideration given the present application. Claims 2 and 34-40 are cancelled herein without prejudice to or disclaimer of the subject matter contained therein. Claims 1, 3-33, and 41-51 are pending, of which claims 41-51 are withdrawn. Claim 1 is amended. Claims 1, 14, 24, 41, and 50 are independent. The Examiner is respectfully requested to reconsider the rejections in view of the amendments and remarks set forth herein.

Examiner Interview

If, during further examination of the present application, a discussion with the Applicants' Representative would advance the prosecution of the present application, the Examiner is encouraged to contact Carl T. Thomsen, Registration No. 50,786, at 1-703-208-4030 (direct line) at his convenience.

Drawings

It is gratefully appreciated that the Examiner has accepted the drawings.

Restriction Requirement

The Examiner has made the Restriction Requirement final, and has withdrawn claims 41-51 from further consideration. Applicants reserve the right to file one or more divisional applications directed to claims 41-51 at a later date if so desired.

Rejections Under 35 U.S.C. § 102(b) and 103(a)

Claims 1, 4, 34, and 37 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Windolph (U.S. Patent 6,439,068);

Claims 2, 8, 9, 13, 14, 15, 18, 19, and 23 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Windolph in view of Suzuki (U.S. Patent 4,986,099);

Claim 5 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Windolph;

Claims 6, 7, 35, 38, and 39 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Windolph in view of Riebel (U.S. Patent 4,706,509);

Claims 10, 11, 12, and 40 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Windolph in view of Shvets et al. (EP 1099484);

Claims 16, 17, 24, and 26-29 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Windolph, Suzuki, and further in view of Riebel;

Claims 20, 21, and 22 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Windolph, Suzuki, and further in view of Shvets et al.

Claims 25, 30-33 and 36 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Windolph, Suzuki, Riebel, and further in view of Shvets et al.

These rejections are respectfully traversed.

Arguments Regarding Independent Claim 1

While not conceding the appropriateness of the Examiner's rejection, but merely to advance prosecution of the instant application, independent claim 1 has been amended herein to incorporate the subject matter of claim 2. Claim 2 has been cancelled.

First of all, Applicants respectfully submit that the Examiner's assessment of Windolph is fundamentally erroneous for at least the following two reasons:

(i) Firstly, the present invention (Application No. 10/787,229) is directed to a method which measures the volume of the droplet via the change in capacitance inflicted by the droplet as it passes through the sensor. The present invention does not measure the charge carried by the droplet (see page 18, lines 10 to 19 and onwards for example).

This significant difference between present invention and the cited prior art is expanded on in detail in the review of the background art in specification of the present application. The background art section discusses Faraday Pails which measure the change of the droplet, in order to illustrate that the method of present invention measures capacitance and not the charge carried by the droplet carried out in the background art. Indeed, Faraday Pails are well-known devices (see for example "Industrial Electronics" by D.M. Taylor and P.E. Secker, Research Studies Press, 1994 ISBN 0-471-152333-8 and "Electrostatics: Principles, problems and Applications" by J. Cross, A. Hilger, ISBN 0-85274-589-3 and US 6,713,021) and are not relevant to the subject-matter of U.S. '229.

This brings us to a discussion of Windolph. The Applicants respectfully submit that the skilled person upon reading the specification of Windolph would understand that the subject-matter of Windolph relates to Faraday Pail technology and clearly covers the measurement of droplet charge only, from which capacitance and other values can be obtained.

For example, in the Abstract of Windolph it is mentioned that "*the droplet charge.....(is measured)*" line 4. Various other passages which mention measuring voltage

charge, include but are not limited to, column 3, line 51, column 5, line 1 to 4, column 5, lines 31 to 33, column 6, lines 5 to 19 etc.

Applicants also submit that although Windolph uses the word “capacitance” in the specification and mentions “*the droplet charge as function of its capacitance*”, a skilled person would understand from reading the specification that Windolph only discloses measuring the droplet charge. This droplet charge measurement thus enables the calculation/measurement of droplet capacitance which in turn is the function of the droplet volume. The same droplet charge measurement is mentioned in all the claims of Windolph, see in particular claims 1, 2, 5 step (d) and (e) and 21 step (b) for example.

The fact that Windolph is focused on the measurement of the droplet charge is also clearly seen from the electrical diagrams, for example Fig. 1 which shows a charge-voltage converter (20). Thus, the electronics measurement circuit indicated in Windolph is charge-voltage converter aimed to measure the charge carried by the droplet. Fig.1 also shows a signal diagram (peak-value detector (24)). We submit that a skilled person would conclude when reviewing Fig. 1 that if the capacitance of the droplet that arrives to collector electrode (16) and terminates its journey at the electrode (16) was measured, then their dependence of the signal versus time would be different to the one indicated in the signal diagram (24). In fact, this signal diagram (24) is consistent with measuring the charge brought to the input of the charge-voltage converter (20) that is gradually being dissipated and not the capacitance as shown in present application. In fact in Figs. 4 to 7 of the present application and their respective description passages, it is shown and explained as to how the experimental curves

would look like the charge carried by the droplet was measured as opposed to capacitance. Please refer in particular to Figure 5 which shows a typical signal induced in a Faraday Pail caused by a droplet passing through the pail. For these reasons, we submit that the skilled person upon reading Windolph would conclude that Windolph clearly relates to measuring droplet charge only.

This difference is also shown in Windolph in column 3, lines 38-41 and the formulas in both columns 3 and 4, which states that *"The droplet capacitance is determined by its diameter, i.e. the mass of the droplet and in turn determines the charge accepted by the droplet"*. Again the skilled person would understand that the logic of Windolph is that they measure the charge of the droplet, from this they work out the capacitance and from this they work out the diameter of the droplet. This point is also illustrated in various passages including column 2, lines 57-58 and column 3, lines 55-60.

In summary, present invention is directed to a method which involves the measurement of capacitance, and not the charge carried by the droplet as per Windolph. This is a crucial difference between the present invention and that disclosed by Windolph.

(ii) A further difference between Windolph and present invention is that Windolph operates only with DC voltage applied to the droplet. A skilled person would understand that if one was to apply AC or RF voltage to the droplet, the method of Windolph would not work as the charge carried by the droplet would be undefined. The charge would depend on the phase of the voltage applied to the droplet at the very moment of its separation. On the contrary, the present invention can in principle work with DC and/or AC voltage. AC voltage

has particular advantages in that AC improves the signal to noise ratio. Applicants also add that all the embodiments in present invention indicate the AC and RF voltage applied to the droplet.

Additional differences between Windolph and the present application are outlined below:

Windolph deals with the completely different set of applications/end uses as compared to the present invention. Windolph is merely directed to slow drug drippers generally used in hospitals. These drops are slowly freely falling drops and that is why their volume is much larger than the typical small dispensed droplets (down to 10 nl) in the present invention. Windolph in fact deals with dispensing drops more than 1 μ l in volume which are spherical in shape (column 4, line 47, column 5, line 53). This is understandable as the freely falling droplet can be in some cases approximately 5 μ l in volume. On the contrary, the present inventors have recognized that liquid dispensed at such small volumes covered will be dispensed in the form of the jet (see page 9, lines 17-22, page 10, lines 21 to 25, page 14, lines 18 and onwards of present application, for example). Recognition of this fact is a fundamental feature of the present invention.

Further, in the method of Windolph, the droplet arrives at the collector electrode and remains in situ (e.g. column 5, lines 51-55). On the contrary, the present invention actually considers the model of a conductor inserted inside a capacitor wherein the jet is the conductor shaft protruding inside the capacitor. This is unique to the present invention,

where the droplet simply passes in the vicinity of the sensor and changes its capacitance by proximity.

With respect to the objections raised in paragraph 3 of the Office Action, the Applicants refer the Examiner to the comments above on Windolph, and stress that Windolph refers to the capacitance only in so far as it is a measure of the droplet volume, see column 2 line 55 etc. Furthermore, as stated above, the electronics measurement circuit indicated in Windolph is charge-voltage converter which only measures the charge carried by the droplet.

With respect to paragraph 4, Applicants add that the discussion on the relationship between the droplet radius and the capacitance is an indication of how Windolph proposed to work out the droplet volume from its capacitance, wherein the capacitance is firstly measured from the charge carried by droplet.

With respect to paragraphs 5 to 6, we submit that the amended claims are patentable for the reasons discussed above.

At least for the reasons explained above, Applicants respectfully submit that the combination of elements as set forth in independent claim 1 is not disclosed or made obvious by the prior art of record, including Windolph.

Therefore, independent claim 1 is in condition for allowance.

Arguments Regarding Independent Claims 14 and 24

Independent claims 14 and 24 remain as previously presented.

In paragraphs 7 to 44, the Examiner has raised objections in respect of Windolph in combination with Suzuki (U.S. Patent 4,896,099), Riebel (U.S. Patent 4,706,509) and Shevets et al. (EP 1099484).

Applicants respectfully refer the Examiner to the comments on Windolph and in view of these comments above, Applicants are of the opinion that the rejections made in these paragraphs are no longer relevant. However, in order to aid the further assessment of the rejections, comments on the additional prior art documents cited are provided. In summary, Applicants submit that independent claims 14 and 24 are patentable by virtue of their dependency on a novel and inventive claim 1.

Our comments on the additional prior art documents follow:

Riebel (U.S. Patent 4,706,509) merely describes an ultrasonic system for detection of particles in suspension. Therefore, Riebel is not relevant to the field of the present application, does not disclose, teach or suggest subject matter relevant to the present invention, and as such, a skilled person would not be motivated to combine the teachings of Windolph and Riebel.

Suzuki (U.S. Patent 4,896,099) merely describes a liquid level alarm/monitor which monitors the level of liquid in a bottle so that it does not fall below a set critical value. The differences between Suzuki and the present invention are significant, at least because Suzuki does not measure the volume of the droplet at all. In addition, Suzuki does not energize the droplet, the liquid only serves as a dielectric medium changing the capacitance of a capacitor attached to the bottle. There is no droplet passing through their sensor, unlike in our

application. As such a skilled person would not be motivated to combine the teachings of Windolph and Suzuki.

Finally, EP 1 099 484, in the name of the same inventors, has been cited. The corresponding U.S. Patent No. 09/709,408 is mentioned in the background art section on page 2, line 25 and page 5, lines 14 to page 7, line 12. These patents relate to Faraday Pail technology and for the reasons given above do not teach, suggest or motivate the skilled person to arrive at the subject-matter of the present invention, either alone or in combination with any of the other cited art.

At least for the reasons explained above, Applicants respectfully submit that the combination of elements as set forth in each of independent claims 14 and 24 is not disclosed or made obvious by the prior art of record, including Windolph, Riebel, Suzuki, and Shevets et al.

Therefore, independent claims 14 and 24 are in condition for allowance.

Dependent Claims

All dependent claims are in condition for allowance due to their dependency from allowable independent claims, or due to the additional novel features set forth therein.

Accordingly, reconsideration and withdrawal of the rejections under 35 U.S.C. § 102(b) and 103(a) are respectfully requested.

CONCLUSION

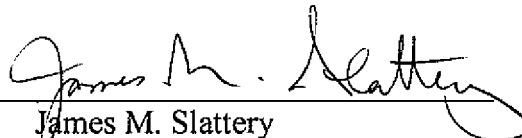
All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. It is believed that a full and complete response has been made to the outstanding Office Action, and that the present application is in condition for allowance.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, he is invited to telephone Carl T. Thomsen (Reg. No. 50,786) at (703) 208-4030 (direct line).

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§1.16 or 1.17, particularly extension of time fees.

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Respectfully submitted,
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